C. Remarks

In the office action, claims 1-48 were rejected under 35 U.S.C. 102 (e) as anticipated by the patent to Lumelsky et al. U.S. patent number: 6,516,350 (hereinafter referred to as,"Lumelsky"). Further, claims 1,12 were rejected under 35 U.S.C. 112 as being indefinite for filing to particularly point out and distinctly claim the subject matter the indefiniteness has been corrected in the claim amendments.

The present invention provides a method and system for handling a request for a resource by applications running on a computer. The resource is part of a plurality of resources that are encapsulated in symbionts. Further, the symbionts run in host programs. The host programs run on computers connected in a network. Applications running on a computer request a resource. Thereafter, the host program running on the computer receives the request and contacts a symbiont encapsulating the resource. The symbiont then handles the request by performing one of the following actions depending on certain conditions:

a. serving the request.

b. redirecting the request to an adjoining symbiont.

c. replicating itself on to the host requesting for the resource.

In contrast, Lumelsky teaches a system and method for regulating server resources distributed in a computer network. Lumelsky relates to a system for regulating resources in a distributed wide area network comprising servers in a computer network. The system includes a plurality of supply resources (e.g., bandwidth, CPU, storage, etc.). Further, the system comprises a plurality of server resources with target multimedia

content, real time processing engines, etc. and a plurality of intermediary system resources such as directories and resource monitors. The resources in any particular server are classified into two groups: global or local. Clients are assigned across the local and global resources. Further the system coordinates the placement of replicas of target content across global resources based on the analysis of utilization patterns of target content and replicas by pluralities of clients.

Independent claim 1

In order to more clearly define, and distinctly claim the present invention from that of Lumelsky, independent claim 1 has been amended to recite that the method of the present invention relates to handling a request for resource on a network of computers. Amended independent claim 1 incorporates the limitations of previous claim 6, now cancelled without prejudice.

According to the method of the present invention, as set forth in amended claim 1, the present invention may be practiced on any type of network architecture between computers. However, Lumelsky's invention is practiced primarily on a client-server architecture. In the present invention, each computer of a network may comprise a host program, and a host program may comprise a self replicating program called a symbiont. Therefore, the present invention does not use any dedicated hardware for replicating a resource. However, Lumelsky's invention teaches the need for a dedicated middleware such as the Service Control Plane (SCP).

The symbiont of the present invention is a self replicating program that encapsulates a resource, such as a network or computational resource. Lumelsky's

object replica is a replica of the target content requested by a client. Further, the symbiont can perform any one of the following steps in respect of a resource: serving a request, redirecting a request or replicating the resource on to a host making the request. Therefore, the symbiont of the present invention is the intelligent decision making component, responsible for resource allocation and distribution. The support for these recitations is found at page 10, lines 26-29, page 12, lines 11-25 and page 13, lines 1-9. It may be noted that as per Lumelsky's invention, the SCP is the decision making component that performs the management of distributed resources (end resources and system resources).

Further, according to the present invention, the replication of a symbiont can occur on a requesting host. However, according to Lumelsky, the replication of an object occurs only on interconnected servers. Moreover, Lumelsky's patent does not mention that a resource can be replicated on a requesting client. It is thus apparent that the present invention offers flexibility and robustness. Further, the present invention may be implemented without any dedicated hardware as both the system and the host are embodied in the form of software components. The support for this recitation is found at page 10, lines 13-15.

Dependent claim 2, 13, 21, and 37

As to claims 2, 13, 21, and 37, Lumelsky teaches that the server computer exposes resources on the network to the clients. In the present invention, the computers in the network comprise host programs, which expose the symbionts in the network, to the applications running on a computer. The applications on a computer are therefore aware

of the resources that are present on the network. This enables the host to manage the communication with the symbionts in a more effective manner as the host would know *a priori* about the symbionts that have the requisite resource. The support for this recitation is found on page 11, lines 2-3. However, in the case of Lumelsky's invention, factors like the willingness factor of a server and the predicted demand of a target content and replicas are taken into account for deciding which server will serve a request from a client.

Dependent claims 3, 14, 22, and 38

As to claims 3, 14, 22, and 38, Lumelsky teaches that a server exposes resources on the client to the network. In the present invention, a computer in the network that comprises a host program exposes a symbiont stored within the host to the network. This feature also enables each host program in the network to have information regarding the symbionts that are present on the network. Therefore, this feature optimizes the time taken for the host program to find an appropriate symbiont that can serve its request. In Lumelsky's patent, the SCP has the information to enable a request from a client to get mapped onto a server. The support for these recitations is found on page 11, lines 1-2.

Dependent claims 4, 15, 23, and 39

As to claims 4, 15, 23, and 39, Lumelsky doesn't teach any logical connection between the object replicas. However in the present invention all replicates of a particular resource are connected together in a logical network. The connection between the resources enables a symbiont in the network to possess the load information about neighboring symbionts. This reduces the time taken for a symbiont to make a decision

regarding the method for handling a request. For example, the symbiont will know which of its two neighbors are less loaded and therefore best suited for redirection of a request. The support for these recitations is found at page 11, lines 9-24. Lumelsky's invention does not teach that the server has the intelligence to decide how to handle a request. He places the intelligence on the SCP as mentioned earlier with respect to claim 3.

Dependent claims 5, 16, 24, and 40

As to claims 5, 16, 24, and 40, Lumelsky doesn't describe the type of connection between the object replicas. Further, Lumelsky does not teach the concept of a multiply connected ring. However in the present invention all replicates of a particular resource are connected together in the form of a multiply connected ring. In a multiply connected ring there is a tradeoff between the networking load and the load for resources. This trade off depends on the number of neighbors to which each symbiont is connected. Hence the present invention provides the flexibility to alter the tradeoff between the networking load and the load for resources. Lumelsky does not provide any such flexibility. The support for these recitations is found at page 11, lines 9-24.

Dependent claim 6 has been canceled without prejudice.

Dependent claims 7-9, 28-30

As to claims 7-9 and 28-30, by reducing the threshold Imax, the number of symbionts that can exist on the network can be increased dynamically (according to the load on the symbiont and the network). For instance, if the requirement of a particular

resource is very high, then the value of Imax may be decreased so that a replicate of a symbiont may be created more easily on a requesting host. Alternatively the value of Imax may be kept higher to minimize the number of possible replicates of the symbiont. Such an alteration in the value of Imax occurs in real time and not on the basis of the predicted demand of the resource (target content of Lumelsky).

Further, Lumelsky doesn't teach the use of two thresholds, Imax and t or the relation between them. However, the present invention teaches the use of two different thresholds. The value of t is deliberately kept lower than Imax as the load of neighboring symbionts is acquired only after a predefined time intervals by the symbiont. Moreover, Imax and t don't depend on the demand statistics that indicate future demand for a resource as is mentioned by Lumelsky. They are not driven by aggregation and forecasting of past data for the demand for resource. The support for these recitations is found at page 12, lines 11-23 and page 13, lines 1-3.

Dependent claims 10-11

As to claim 10, the present invention recites that a symbiont will redirect the request to the neighboring symbiont with the least load. The support for this recitation is found on page 12, lines 18 – 24. As to claim 11, the symbiont closest to the host making a request for a resource will be used for handling the request. The closeness may be in terms of the geographical distance or any other parameter that may be predefined. The support for this recitation is found on page 15, lines 3-5. Therefore, according to the present invention, the symbiont has the intelligence to choose the neighbor that is best suited for handling a request. Further, the system is configured such that the symbiont

closest to the request host handles the request. This step decreases the time taken for a request to be handled, thereby increasing the speed of handling of a request. The above steps, therefore, increase the efficiency of a request being handled.

In Lumelsky, the SCP determines the ideal server for handling of a request based on factors such as the demand for the target content, willingness of a server, number of replicas available and the resources available with each server making the entire process dependent on the SCP middleware. In the present invention, there are multiple copies of the component with intelligence (symbiont) which makes the system robust.

Independent claim 12

In order to more clearly define, and distinctly claim the present invention from that of Lumelsky, independent claim 12 has been amended to recite that the system of the present invention relates to handling a request for resource on a network of computers. According to the system of the present invention, as set forth in amended claim 12, the present invention may be practiced on various types of network architecture between computers. However, Lumelsky's invention may be practiced primarily on a client-server architecture. Each computer of a network may comprise a host program. Further a host program may comprise a self replicating program called a symbiont. Therefore, the present invention does not use any dedicated hardware for replicating a resource. However, Lumelsky's invention teaches the need for a dedicated middleware such as the Service Control Plane (SCP).

The symbiont of the present invention is a self replicating program that encapsulates a resource, such as a network or computational resource. Lumelsky's

object replica is a replica of the target content requested by a client. In one embodiment, the symbiont handles the request for a resource by replicating itself on the requesting host. The replication takes place if the load on the symbiont exceeds a threshold lmax and if the request has been redirected more than a specific number of times, rmax. Alternatively, the symbiont replicates on the requesting host if the load on the symbiont exceeds lmax and the load on the neighboring symbionts that encapsulate the resource is greater than the threshold t. Therefore, the symbiont of the present invention is the intelligent decision making component, responsible for resource distribution. The support for these recitations is found on page 12, lines 9-25 and page 13, lines 1-8. It may be noted that as per Lumelsky's invention, the SCP is the decision making component that performs the management of distributed resources (end resources and system resources).

Furthermore, according to the present invention, the replication of a symbiont can occur at a requesting host. However, in Lumelsky, the replication of an object occurs only on interconnected servers. Moreover, Lumelsky's invention does not teach that a resource can be replicated on a requesting client.

Dependent claims 17-19 have been canceled without prejudice.

Independent claims 20 and 36

As to claim 20 and 36, Lumelsky teaches a method and system for regulating resources in a client-server architecture. However the present invention defines hosts, symbionts and resources that are not limited to client-server architecture. For example, the invention can be practiced on a peer to peer architecture in a LAN environment. In

other embodiments, a WAN or a MAN environment may also be used for the enablement of the invention. The only requirements for the enablement of the invention are the software programs such as the symbionts and the hosts.

The fact that the resources are logically connected in a multiply connected ring network makes the network of resources robust. The arrangement also facilitates better sharing of information amongst the symbionts. Further, a symbiont along with the resource is replicated rather than the resource (object replica) alone as claimed by Lumelsky. In the meaning, the intelligence required for handling a request for a resource is replicated making the network of symbionts extremely intelligent software, capable of increasing in scale, as per the demand of resources. Therefore, if the load on a symbiont increases above a threshold value (lmax), the symbiont replicates. Similarly, the symbionts cease to exist if the load on the symbiont falls below a minimum threshold value, thereby keeping the number of symbionts at an optimum level. The support for these recitations is found at page 10, lines 12-29.

Dependent claims 25,26 and 41-42 have been canceled without prejudice.

Dependent claim 27

In claim 27, the birthing rules are governed by the load on the symbiont handling the request, the number of redirections of a request and the load on the neighboring symbionts. A symbiont is replicated on a requesting host if the load on the symbiont is greater than lmax and the number of redirections exceed a value rmax. Alternatively, the symbiont is replicated if the load on the symbiont exceeds lmax and the load on the

neighboring symbionts exceeds the value t. The support for this recitation is found on page 12, lines 10-15.

In contrast, Lumelsky links the birthing rules of replicas to resources owned by servers. It may be noted that the servers do not possess intelligence of their own and are dependent on the intelligence of the SCP for resource allocations and distribution. Further, Lumelsky doesn't teach the use of two thresholds, Imax and t and the relation between them. However, the present invention teaches the use of two different thresholds. The value of t is deliberately kept lower than Imax as the load of neighboring symbionts is acquired only after a predefined time intervals by the symbiont. Moreover, Imax and t don't depend on the demand statistics that indicate future demand for a resource as is mentioned by Lumelsky. They are not driven by aggregation and forecasting of past data for the demand for resource. The support for these recitations is found at page 12, lines 11-23 and page 13, lines 1-3

Dependent claims 31 and 44

As to claims 31 and 44, the present invention further elaborates on the process for arranging resources in a network of computers. One of the symbionts is marked immortal so that the intelligence required for handling a request for a resource is never deleted. In the present invention, it is the symbiont that is immortal i.e., the intelligence required for handling a request is kept immortal. Therefore instead of maintaining an entire hardware (SCP of Lumelsky), the present invention teaches the use of keeping only a single symbiont alive as a means to carry forward the intelligence request for handling a request. The support for this recitation is found on page 13, lines 21-24.

Dependent claims 32 and 45

In claims 32 and 45, it is recited that a symbiont may cease to exist if the load on the symbiont falls below a threshold lmin. The load is checked at regular time intervals and it is ensured that the time intervals are not kept too short so as to avoid churning. This ensures that the total number of symbionts is kept at an optimum level. The support for these recitations is found at page 13, lines 16-19. Lumelsky's method however teaches the use of the SCP for maintaining the ideal number of replicas. According to the graph of Lumelsky (Fig. 9), the replicas of the target content are created according to their predicted demand. However, the present invention does not relate to demand prediction of resources, thereby eliminating the need for prior computations.

Dependent claims 33–34 and 46-47

In claims 33 and 34, it is recited that that the time interval for a symbiont to check its own load depends on the time scale of natural fluctuations in load on a symbiont. Therefore the time intervals depend on the actual load variations on a symbiont measured in real time. However, the number of replicas in Lumelsky's invention depend on the predicted demand of the target content or replicas. The support for these recitations is found at page 13, lines 18-20.

Dependent claims 35 and 48

In claims 35 and 48, it is recited that one of the symbionts is marked immortal and never ceases to exist. The symbiont is marked immortal so that the intelligence required

for handling a request for a resource is never deleted. The support for this recitation is found on page 13, lines 20-24. Lumelsky teaches the use of the SCP as an immortal entity. It may be noted in light of the aforementioned that a software program such as the symbiont being kept immortal in a network is easier to maintain compared with an elaborate hardware such as the SCP.

Dependent claim 43 has been canceled without prejudice.

The present claims have been amended to highlight the distinctions of the present invention over the prior art and it is respectfully submitted that the claims are now clearly patentable over the art of record, and notice to that effect is earnestly solicited, If the Examiner has any questions regarding this matter, the Examiner is requested to telephone the applicants' attorney at the numbers listed below prior to issuing a further Office Action.

Respectfully Submitted,

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